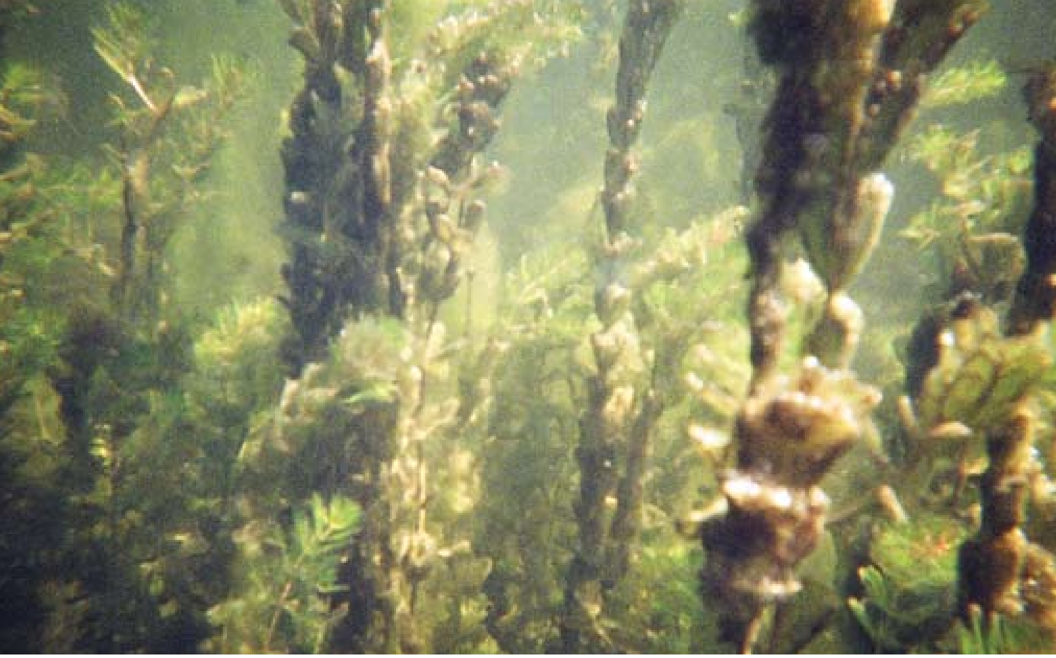

Aquatic Plants Guide

Aquatic plants in the Kawartha Lakes – their growth, importance and management

KLSA

Kawartha Lake Stewards Association
2009

Aquatic Plants Guide

Aquatic plants in the Kawartha Lakes –
their growth, importance and management

A 2009 publication by

The Kawartha Lake Stewards Association (KLSA)

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Disclaimer

Attempting to control aquatic weeds is a potentially illegal, and potentially hazardous, activity. You are responsible for understanding and complying with all applicable legal requirements; for obtaining any required permits; and for taking all due care for your own safety, in addition to that of the watershed, in any action you may take to control weeds. The laws and regulations in this area are constantly changing, and accordingly, you should check for changes before beginning any related activities. It is not the purpose of this report to advocate or recommend attempts to control aquatic weeds at all. In many circumstances, efforts to control aquatic weeds may prove to be futile or even counterproductive. Nor does this report advocate or recommend any particular response to aquatic weeds.

In no event shall KLSA be liable for damages of any kind whatsoever arising out of reliance on this publication, including without limitation damages for personal injury, property damage, or environmental damage, or for liability to third parties or arising under applicable regulatory statutes.

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More information on KLSA can be found at http://klsa.wordpress.com

Living in the Kawarthas

The Kawartha Lakes are a broad necklace of sparkling lakes carved out by glaciers and their meltwaters as they retreated from the mid-continent around 12,000 years ago. For generations, native peoples lived among these lakes and their many wetlands, using the area's vast resources of fish, game and an abundance of plant food such as wild rice to sustain their culture. Today, due in large part to the building of the dams and channels of the Trent-Severn Waterway (TSW) early in the last century, much of this wetland habitat was flooded, and now we find many more human developments along the lakeshore margins. The lakes are still a precious resource to us, and they are in need of our stewardship, for human impacts over the past century and a half have been changing, and in some ways threatening, the health of the Kawarthas.

Living Lakes

In contrast to many northern lakes of the Canadian Shield, such as the Muskokas, the shallower Kawartha Lakes are naturally more productive ecosystems. That is, they are full of life, and can support a greater number of organisms. Many native species of aquatic plants, and some non-natives, form mini-forests underwater where **fish** find shade, protection, food, and places to lay eggs or build nests. **Aquatic plants provide "services" for human beings too**. They help clarify lake water and slow the action of waves that erode shorelines. Healthy aquatic plants also make it less likely that algae will take over a lake, which can result in smelly surface scum that can even be toxic.

The Kawarthas receive ample nutrients for plant growth from the local soils derived from beds of limestone that form their southern shores and lake bottoms. Prior to the creation of the Trent-Severn Waterway, many of these fairly shallow lakes abounded with very diverse wetland and aquatic plant communities. Many of the wild rice stands that have recently reappeared are in locations where we believe they historically existed, perhaps aided by increases in water clarity as a result of the filtering activity of zebra mussels. But **when levels of nutrients like phosphorus and nitrogen increase to higher-than-natural levels in the water, they become a strong fertilizer** for excessive plant growth, especially for the large clouds of cotton-candy-like **algae** that have become a common sight in many of our Kawartha Lakes. Too much of this algae can ultimately lead to drastic changes in the health and appearance of our lakes.

Human Inputs

Where do the extra nutrients come from?

- From atmospheric deposition of airborne dust from cities and

farmlands as well as chemicals from coal-fired plants and vehicle exhausts;
- from local agriculture;
- from less-than-adequate controls of effluent at sewage treatment plants (six discharge into the Kawartha Lakes);
- from urban stormwater runoff from the towns and villages of the Kawarthas, which can contain garden chemicals, pet waste, road salt, and anything that goes down the storm drains; and
- from the shoreline itself – garden fertilizers applied too close to shore, and leaky septic systems.

We all need to be responsible stewards of the Kawartha Lakes, from town dwellers to cottagers and year-round lakeshore residents and businesses. **Climate change**, already detected to be underway in the Kawarthas, is expected to warm up the water, and perhaps will contribute to further alterations in our lakes. Thus, the sooner we all get into the habits of good shoreline practices and urban storm and wastewater treatment – all actions that we can control – the better it will be for the lakes.

This Guide

For many years, people in the Kawarthas have used a variety of techniques – some expensive, some homemade – to try to reduce aquatic weed growth in the vicinity of their docks. But what works well? And how are the control methods affecting the aquatic habitat?

In response to a strong demand from members of the Kawartha Lake Stewards Association (KLSA) and other shoreline residents, KLSA undertook a two-year project, largely funded by the Ontario Trillium Foundation (OTF), to begin to answer these questions. This Aquatic Plants

Guide is the end result of last summer's research project. In it, we describe the most common methods of aquatic plant control people are using in the Kawarthas and present our research findings on the effectiveness of each technique. We also gauged the condition of the aquatic habitat after the control methods were used by observing the plant communities that grew back afterwards, and identifying the benthic macroinvertebrate species and communities, or the "bugs" that live in lake sediments. Other possible harmful effects of control methods – such as the effects of herbicide on the sources of drinking water for some towns and cottages, or the effects of large mechanical harvesters on fish – were beyond the scope of the study.

The Guide is not a "how-to" manual on aquatic weed control. **KLSA does not *recommend* any of the techniques that our team studied**. Rather, we present the study findings to you, so that you can make an informed decision about what – if anything – to do about the aquatic plant communities off your dock.

Be advised that some of the methods of aquatic plant control that we studied may not be suitable for your lake: benthic mats are not allowed within the Trent-Severn Waterway and using sand to smother weed beds is not allowed anywhere in Ontario. However, we decided to include these methods because people are using them. Even the allowed methods of aquatic plant control, except for one, require permits from one or more government agencies. The permitting process is complicated, and we do our best to describe it on pages 15 through 18. **Please do not undertake control methods described in this Guide without a permit!**

Living in Harmony with Nature

The areas off docks that shoreline owners may be "managing" are tiny in comparison to the total nearshore habitat of most lakes. However, even in such small areas, "no management" may be the best option. Depending upon local conditions and regulations, one might extend a dock out into deeper water, or use a swimming platform, thus mostly avoiding the weed beds rather than disturbing them. We should never use lawn and garden chemicals anywhere near the shore, for rain will wash them into the lake to fertilize the aquatic plants. Leaky septic systems have the same effect.

Sometimes when you get to know an adversary, you end up becoming friends. If you think of aquatic plants as weeds to be killed, try getting to know them better. The purpose of our plant ID key beginning on page 30, is to aid you – and your children and grandchildren – in noticing, identifying and appreciating the variety of healthy native aquatic plants that are present in the Kawartha Lakes.

Between the shoreline and lake, between the air and water, aquatic plants grow!

From bulrushes to water lilies, from floating duckweed to underwater pondweeds, each has its role to play...

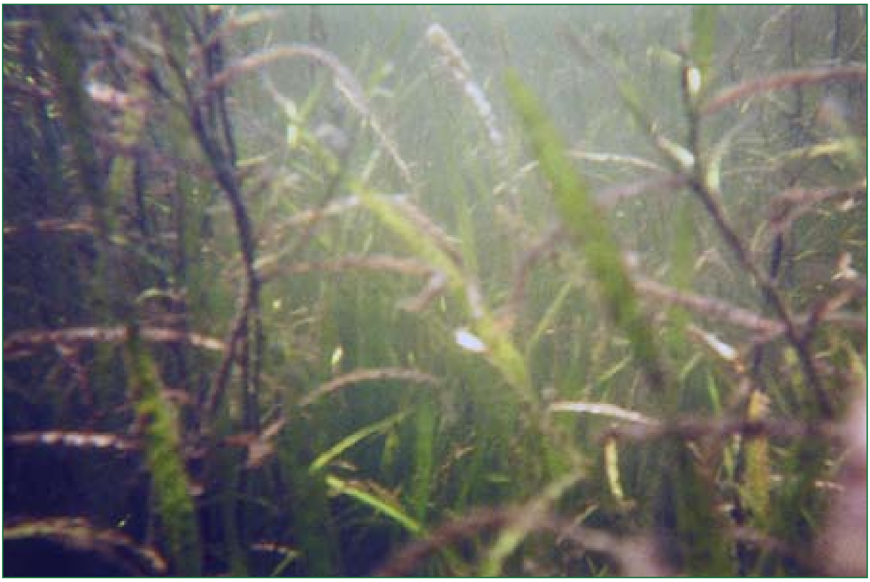
Emergent plants are found in the transition area between land and water. They are important as nesting grounds for waterfowl like ducks and geese, and as food sources for mammals such as muskrats and moose. By looking closely at emergent plants, you may be lucky enough to see a dragonfly break out of its larval case!

Floating leaf plants, such as the showy water lilies, are common in quiet, calm areas of lakes. By shading the water underneath them, floating leaf plants create an open underwater environment that is ideal hunting ground for fish in search of small aquatic invertebrates. Small plants that float freely on the water surface are tasty snacks for ducks as they swim around.

Submersed plants create diverse and complex underwater habitats in lakes. Fish, such as bass and sunfish, make their nests in submersed plant beds, and young fish will use the plant beds to hide from larger piscivorous, or predatory, fish. Zooplankton also use plant beds as hiding spots, and the edges are often good places to watch fish hunt for food.

What have they done for me recently?

In addition to providing habitat for fish, native species of aquatic plants help to protect your shoreline from erosion by slowing wind and wave currents. They provide calm areas for sediments to settle to the lake bottom and thus increase water clarity, and their presence helps resist invasion from non-native plant species.



There is a battle going on in your lake!

Small algae and bacteria that float around in the water, collectively called phytoplankton, compete with aquatic plants for nutrients and sunlight. Phytoplankton cloud the water and, in extreme cases, can turn the water a milky-green. Because of their small size, they use nutrients available in the water to grow and reproduce quickly, BUT the larger plants can create shade underwater and prevent the phytoplankton from getting the sunlight they need to survive. **Therefore, aquatic plants play an important role in moderating phytoplankton growth and maintaining the clear water of our lakes.**

Zebra mussels also play a role in this battle. They are small, freshwater mollusks that grow attached to hard surfaces and feed on phytoplankton in the water. They can increase water clarity as well as deposit nutrient-rich feces on the sediment, both of which can tip the balance in favour of plant growth.

Plants are producers. They grow by creating their own food, through the process of photosynthesis, which utilizes a source of carbon (carbon dioxide or bicarbonate), water and sunlight.

A plant's ability to obtain sunlight depends on:

Water depth – shallow water allows more light to reach the bottom.

Water clarity – clear water allows light to penetrate deeper.

Plant growth form – plants at or near the water surface capture more sunlight than those growing on the lake bottom.

To be healthy, plants need other nutrients, most importantly nitrogen and phosphorus. Phosphorus is important for producing seeds and spores for reproduction, and nitrogen is important for growing new shoots and leaves. Sediments are the major source for nutrients, but plants can also pull dissolved nutrients from the water.

Plants are fragile. Their stems, leaves and flowers can be broken or flattened by wind and wave currents. Submersed plants are quite flexible and can bend and move with the water. Floating leaf and emergent plants are more delicate and favour sheltered bays.

If your shoreline has...

- A gradual slope from shallow to deep water,
- A lake bottom that is mud, silt, sand, or a combination of these,
- Protection from wind and waves, such as a sheltering point or an enclosed bay,
- A nearby marsh or swamp,

Expect high plant growth!

Aquatic WEEDS

There is much debate as to when the abundance of aquatic plants in a lake is excessive. Typically, we begin to call them "weeds" when they impede our ability to enjoy the lake. Weeds are defined as any plants growing where they are not desired, which means that "weeds" can be different for everyone. The location and abundance of the plants are often important. Weeds may be:

1. plants found in our swimming areas, around docks and in boat channels,
2. plants that grow on the water's surface,
3. plants that grow so densely that they fill the water column and decrease the quality of the aquatic habitat.

Regardless of how you define them, many lakeshore residents have been trying to control aquatic plants for years. With frustrations mounting, the Kawartha Lake Stewards Association (KLSA) undertook a study in the summer of 2008 to look more closely at plant control methods.

How well do these methods manage plants?
Are they time and/or cost effective?
What impact do they have on the plant community?
Will invasive species increase with these methods?
How are they impacting the lake ecosystem?

invasives

Invasives are non-native species that grow rapidly in new regions

Eurasian milfoil, an invasive aquatic plant, is well known throughout the Kawartha Lakes. It forms a dense canopy near the water's surface and shades out plants below.

Curly-leaved pondweed is a submersed invasive present in the Kawartha Lakes. It forms dense beds, but its abundance is not nearly as great as Eurasian milfoil.

Fanwort is a submersed plant that is commonly sold through aquarium or garden centres. It is known to have invaded only one lake in Ontario, Kasshabog Lake, where it has been very aggressive. Kasshabog Lake is directly east of the Kawartha Lakes.

Who's doing what and why?

On its website, KLSA surveyed residents and cottagers of the Kawartha Lakes in the spring of 2008 to find out what they thought of aquatic plants, and to see which control methods they had been and were using. Responses came from **126 people** on **20 different lakes**, within the Trent-Severn Waterway and beyond.

When asked about recent changes to plants along their shoreline,

6% said there were no changes
36% said they noticed more Eurasian milfoil
25% said there was more tape grass
15% said there were more emergent plants
48% saw more algae
58% said there were more plants, but they didn't know which type
2% saw a decrease in plant abundance

Who is trying to control or manage plants?

64% of the survey respondents had tried to control plants in the past, while 36% had not tried any method.

Were respondents going to try to control plants again the next summer?

41% YES   39% NO   20% UNSURE

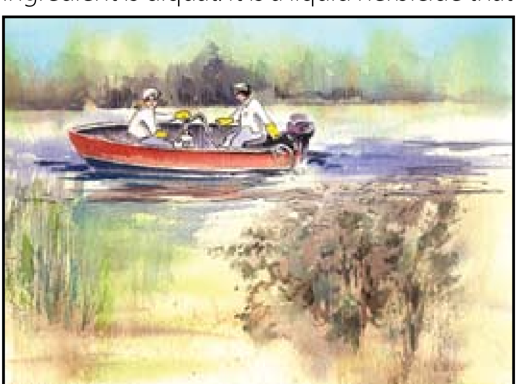
Methods of Controlling Plants

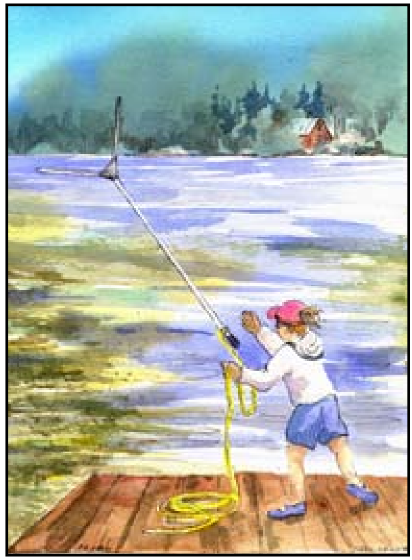
Following are the main methods being used to control aquatic plant growth in the Kawartha Lakes. These methods were examined closely in KLSA's research study, but they are not an exclusive list. We were not able to study other methods such as hand pulling.

Controlling aquatic plants usually requires permits! Please see pages 15-18 for permitting and advisory agencies in your area.

Benthic mats are covers laid on the lake bottom that prevent rooted plants from obtaining the sunlight they need to grow. They are often a heavy black cloth, similar to landscaping fabric, but can also be plastic sheeting or screening. They can be difficult to put down, especially in deeper water, and are cumbersome to move. Mats left in the water will accumulate sediments and allow new plants to root on top of them. Mats should only be laid down *after* fish spawning in the spring, and should be removed at the end of each season. Benthic mats are not permitted in the Trent-Severn Waterway.

Herbicides are a chemical treatment that targets and kills plants. There is only one herbicide permitted for use in Ontario: Reward® whose active ingredient is diquat. It is a liquid herbicide that requires direct contact with the plant in order to be effective. Only the above-ground plant material is affected, not the roots. Herbicide application requires a permit and must be applied by a trained individual using proper safety equipment. Herbicides are applied once, in July, on a day that has calm wind and water.





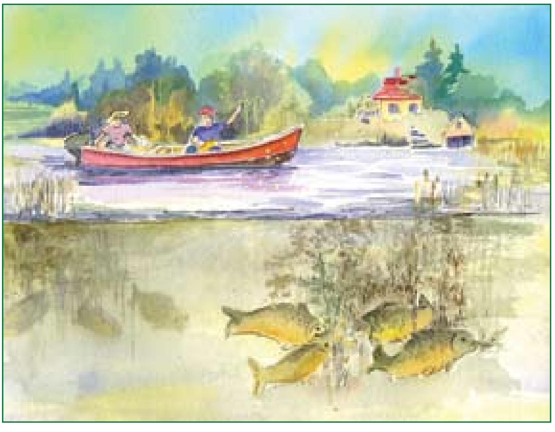
Cutters include many different types and makes, including the Weedsickle® and the Weed Razer®. All cutters work by cutting off the tops of the plants. The cuttings must then be collected and disposed of on land, to prevent them from taking root elsewhere. How much of the plant is cut and how deep they work depends on the type of cutter. Cutters that mount on the back of a boat can be raised and lowered. Depending on the water depth, they may cut off all or some of the plant. Other cutters are attached to a rope and can be thrown from shore or the dock. They sink to the lake bottom where they cut off the plants just above the bottom as they are pulled in. Cutting may have to be repeated frequently depending on plant growth and abundance.

Mechanical harvesters are large-scale plant cutters and collectors. They cut off the plants above the sediment surface, leaving the roots untouched, and also remove the cuttings from the water. A cutting blade is mounted onto the front of a boat, and hydraulics are used to raise and lower the blade depending on the water depth. Behind the blade is a conveyor belt that collects the plants as they are cut and dumps them into the boat so they can be deposited onto the shore. Depending on the operator, harvesters can cut plants as deep as 2 metres and as shallow as 50 cm. Harvesting can be done as frequently as desired; however, operators may only visit a region once or twice a season and the cost, which depends on the area cleared, is substantial.

Raking from shore, the dock, or right in the water, collects plants so they can be removed from the water. Rakes remove mainly the above-ground plant material and leave most roots undisturbed. They are also used to collect floating mats of plants which have drifted in from other areas of the lake. Specialized rakes with longer prongs and extend-able handles can be used, as well as ordinary garden rakes. Raking may have to be frequently repeated, depending on the plant growth on your shoreline. Because the prongs scrape the lake bottom, rakes should not be used until after July 15, when fish spawning is over. Raking should also not be used in areas where rocks, gravel or other substrates that fish use for spawning would be removed.

Homemade dredges or **drags** are control methods that affect the sediments. Dredging is sometimes done in canals and waterways to increase navigability and involves physically removing sediment from the system. Homemade dredges or drags for plant control disturb rather than remove the sediments, and they may also act like a rake to collect the disturbed plants and roots. These dredges include bed-springs, large pronged rakes, and any other device that is weighted to sink into the sediments and disturb plants at the roots. They are often attached to the back of a boat, weighed down with rocks, and pulled around. Frequency of this treatment will depend on the speed of plant regrowth. The Department of Fisheries and Oceans does not recommend dredges as they can be highly disruptive to fish habitat, and they are not permitted on the TSW.

Kernels of corn are thrown into the water along the shoreline, from the dock, or from a boat in order to attract carp to the area. Carp feed on aquatic plants and thus remove them by eating them or by dislodging their roots and allowing wind and wave action to carry the plants away or to the shore. Dried feed corn is used for this method. This method is used in early spring and continues throughout the summer, as often as wished. Downsides to this method are that carp often prey on the eggs of native fish; their feeding on the corn can also increase local levels of turbidity in the water and dislodge plants that will be fragmented and dispersed.



Permits and Resources

The permitting process can be confusing. We have sifted through the information from the agencies that advise and issue permits to create the following summary. But keep in mind that **regulations change**. Ultimately it is the shoreline owner's responsibility to ensure that the laws and regulations are being followed in any attempts to control aquatic plant growth. Contacting more than one agency is a good policy.

Because of the importance of aquatic plants in lake ecosystems and as fisheries habitat, all of the plant control methods discussed in this Guide, except using corn to attract carp, require a permit within the Kawartha Lakes area and throughout the Trent-Severn Waterway (TSW). Additionally, some methods are not allowed at all, depending upon the jurisdiction.

Ministry of Natural Resources (MNR)
For Ontario as a whole, permit requirements depend upon where you live and how large an area of plants you wish to control. The following map is a guide to permit requirements for areas outside the TSW, which is under federal jurisdiction:

If your property is **south of Highway 7 or Highway 401** on the map (white area), is not part of the TSW, and you wish to remove plants from an area **less than 100 metres square**, no permit is required, but follow DFO's Friendly Practices (see below) to help protect fish habitat. However, if your plant removal is in a wetland or a site where Species at Risk (SAR) may be present, additional approvals may be necessary, so contact MNR. If you wish to remove plants from an area **100 metres square or greater**, contact your local MNR office, as a permit is necessary.

If your property is **north of Highway 7 from Lake Huron to Sharbot Lake, or north of Highway 401 from Kingston to the Quebec border** (grey region on the map), and not located on the TSW, contact your local MNR office for a permit.

In summary, if your property is outside of the Trent-Severn Waterway (TSW), then MNR should be your main contact.

Call MNR's toll free line to be directed to the appropriate district office: 1-800-667-1940. Or visit the website:

http://www.mnr.gov.on.ca/en/ContactUs/

Herbicide Permits
No matter where you live in Ontario, if you wish to use a herbicide to control aquatic plants along your waterfront you **must** have a permit from the Ontario Ministry of Environment (OMOE), both to purchase the herbicide and to apply it. This OMOE permit is in addition to any other permit requirements listed.

Call OMOE's toll free number at 1-800-565-4923, or visit their website at

http://www.ene.gov.on.ca/

and follow the links to pesticides.

Parks Canada – Trent-Severn Waterway (TSW)
If your water body is part of the TSW (see list of TSW lakes and rivers on page 39), you must obtain a permit from Parks Canada, TSW, for any plant removal or herbicide use. Note that herbicide use is not encouraged on the TSW, and not all applications for a permit are approved.

TSW prohibits **benthic mats** in the Waterway, even in small areas, because they create an artificial barrier between the lakebed and the water column in the productive near-shore zone, interfering with the life cycles of some species. Using **sand** to smother aquatic plant beds is also prohibited in the TSW and throughout Ontario.

For plant removal or herbicide use in the TSW, Parks Canada provides these guidelines for permit applications:

Plant Harvesting: Maximum width of harvesting area is 50% of the water frontage, up to a maximum of 10 metres; the area may extend up to 30 metres out into the water body. Emergent vegetation, rocks and logs must not be disturbed. A permit for harvesting aquatic vegetation will not be approved in areas of emergent wetland vegetation, or where Species at Risk or their habitat may be negatively impacted.

Herbicide Treatment: Maximum width of treated area is 50% of the water frontage, up to 10 metres; the area may extend up to 15 metres out into the water body. A boat channel 6 m wide by 15 m long may also be treated if it is deemed necessary and the permit includes conditions for such a channel. Herbicide will not be permitted in proximity to a wetland, or in an area where there are known Species at Risk, under any circumstances.

If the proposed harvesting or herbicide use may impact fish habitat, Parks Canada will send the application to the Department of Fisheries and Oceans (DFO) for advice before issuing the permit. No permit will be issued by TSW if there is the potential for negative impacts to fish or fish habitat.

Parks Canada/TSW can be reached at 705-750-4900, or visit

http://www.pc.gc.ca/trent/

It can take months to obtain a permit, so plan ahead and contact MNR, OMOE or TSW well before the summer.

Department of Fisheries and Oceans (DFO)
DFO administers the federal Fisheries Act, which prohibits the harmful alteration, disruption or destruction of fish habitat (HADD). They do not issue permits, but rather provide advice to other agencies as well as to

the public for preventing or mitigating HADDs. Following DFO's "Friendly Practices" guidelines, found on their "Working Around Water?" fact sheets will simplify your application for a permit from TSW or MNR. Fact Sheet I-2 ("Fish Habitat & Controlling Aquatic Plants") is particularly relevant. The Fact Sheets are available at DFO offices or online at:

http://www.dfo-mpo.gc.ca/regions/central/pub/factsheets-feuilletsinfos-on/index-eng.htm

A DFO letter of advice may be required in order to obtain a permit to remove aquatic plants from lakes administered by MNR. If a project may result in a HADD, then the other agencies will wait for DFO authorization before proceeding with their permitting process. Areas of critical spawning habitat may not be approved for aquatic vegetation removal. In practice, Parks Canada and local Conservation Authorities can issue letters of advice on behalf of DFO.

The Peterborough District DFO office number is (705) 750-0269. For other offices, consult the blue government pages in your local phone directory.

Conservation Authorities (CAs)

Conservation Authorities provide approval for building projects close to and affecting water bodies but do not have jurisdiction for work below the high water mark. Consequently, they do not have authority over aquatic plant removal, unless it is part of a project at the shoreline. As noted, however, they can stand in for DFO in advising the permit granting agencies.

Nevertheless, knowledgeable staff at your local CA may be your first point of contact in getting started on a permit application, especially if your property is located outside the TSW. Not all parts of the Kawartha Lakes are within the jurisdiction of a Conservation Authority, but the two that have responsibility for much of the area are:

Kawartha Conservation, in the City of Kawartha Lakes: 705-328-2271, or website

http://www.kawarthaconservation.com

and Otonabee Region Conservation Authority (ORCA), in Peterborough County: 705-745-5791, or website

http://www.otonabee.com

To find a CA in other areas go to

http://www.conservationontario.ca/find/index.html

Aquatic Plants Study

In order to determine the effectiveness of the plant control methods being used in the Kawarthas, KLSA undertook a research project, the Aquatic Plants Study. The study was conducted through Trent University during the summer of 2008 by Dr. Eric Sager, Master's student Andrea Hicks, and five crew members.

The researchers chose 20 sites, volunteered through the KLSA online survey, from different lakes across the Kawartha Lakes. At each site, residents were using methods to "manage" the plants; each of these **treatment sites** was compared to a **reference site**, a comparable area where no management activities were taking place. Eight plant management techniques were included in the study. Each site was sampled at least twice, in early summer (June/July) and late summer (August); herbicide and mechanical harvester sites were also sampled shortly after the treatment was done in mid-July.

Plants were sampled to determine:

- **biomass** – how many plants were present, and their mass as determined for a given area,
- **species richness** – the total number of species found, and
- **species diversity** – how balanced or evenly distributed the species were in the community; more species, evenly distributed, mean greater diversity.

Aquatic macroinvertebrates (small animals visible to the eye, such as snails, insect larvae and beetles that live in the water) were sampled to see how other parts of the lake community were affected by the plant control methods; the presence or absence of different macroinvertebrate species can tell us about habitat disturbance or the food web of the lake. Food web refers to the pathways by which nutrients are cycled through the different trophic levels (i.e. sediment, plants, insects, fish) of the lake.

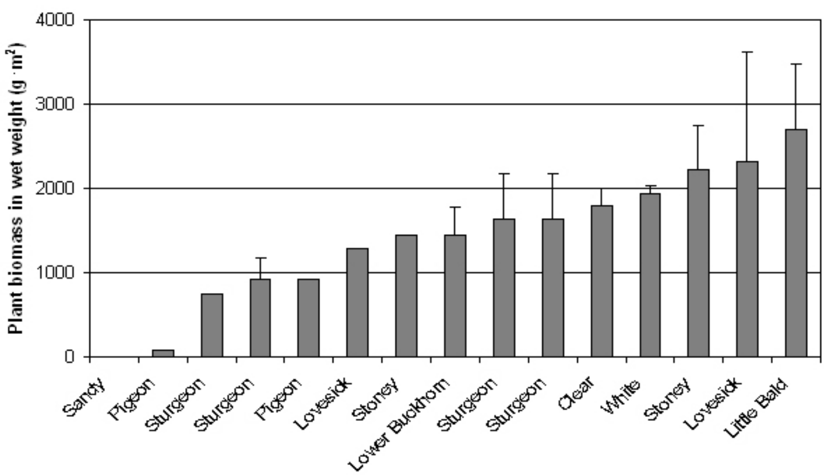
Sediment was collected at each site to determine how much organic material was present. More organics mean more nutrients available for plant growth.

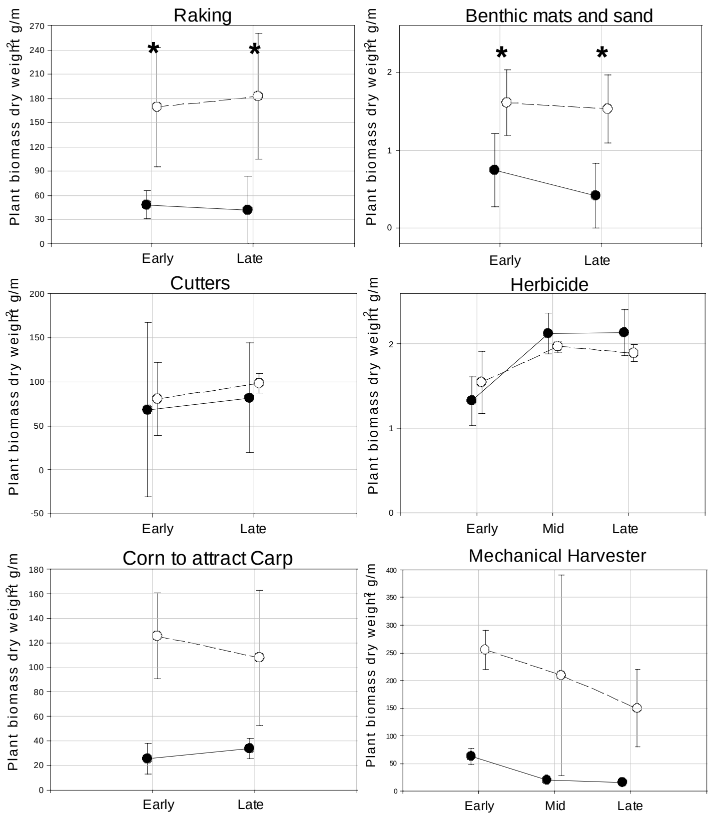
The individual sites that were used for our study are listed in the table below, showing the lakes and different management techniques that were applied by shoreline residents.

Lake	Management	Lake	Management
Clear	Raking	Sandy	No management
Little Bald	Raking	Stony	Corn for carp
Lovesick	No Management		Cutting by hand
	Benthic mat	Sturgeon	Herbicide
Lower Buckhorn	Rake/Dredge		Benthic mat
	Throw cutter		Throw cutter
	Sand on lake bed		Corn for carp
	Boat cutter	White	Raking
Pigeon	Sand on lake bed		Benthic mat
	Herbicide		Mechanical harvester

In the following pages, some management types were grouped together: benthic mats includes sand on the lake bed; all cutters are grouped; and rakes and rake/dredges are grouped.

How Many Plants? This graph shows how many plants (biomass in grams) were found at each of the reference sites in late summer. Reference sites are unmanaged areas near and similar to treatment sites that serve as a scientific control. The site on Little Bald and another on Lovesick were the sites with the greatest biomass.





These graphs group the sites based on their management type. For example, all the rake sites are represented by the “Raking” graph. Each graph shows how many plants (biomass) are present at the **treatment sites (black circles)** compared to the **reference sites (open circles)**. Each circle represents the average for all the site values, with the vertical bars showing the range of those values.

Most of the graphs show the black circles (treatment sites) lower than the open circles (reference sites). This means the **plant control methods are decreasing the amount of plants**. (Herbicide is the exception and will be discussed later). The stars on the Raking and Benthic mat graph mean that the decrease in plant biomass is **consistent across all sites**. For the other methods, not all sites show the same amount of decrease. This means that if you and your neighbour are using one of these methods, you may not both have the same decrease in plant abundance. This may relate to how favourable each area is for plant growth, in terms of sediment, sunlight and shelter.

The herbicide graph is different from the others because the amount of plants was actually **higher at the treated site** after the treatment took place (mid- and late summer). The two herbicide sites reacted very differently. After treatment, one site had plant species similar to those before treatment but fewer of them, whereas the other site had one species grow abundantly and replace the existing plants. So while the herbicide decreased the abundance of most plants, it increased the abundance of one species, *Chara* (muskgrass), and thus did not reduce the overall biomass.

Plant Community

Species presence and abundance in the community

How do these management techniques affect the plant community? Ideally, the management method would **affect all plants equally**: it would maintain the original species and their proportions in the community, while decreasing overall biomass. The table on the right shows an index of changes in the plant community: the **Percentage Similarity Index (PSI)**. This index compares the managed and reference plant communities, considering both the **species present and their proportions** in the community, and determines how similar the two sites are. A value of 100% would mean the managed and reference communities were identical; the lower the values, the more dissimilar the communities and the greater the negative impact of the management technique. High values, such as those at the Sturgeon cutters and herbicide sites, mean the communities are almost exactly the same, which is good. Low values, like sites Sturgeon-benthic mats (where no plants were present at the managed site) and Pigeon-herbicide (where *Chara* replaced the existing community) mean the communities are very different. On average, harvesting and benthic mat treatments created the greatest change in plant community, whereas the cutters had the most similar managed and reference communities.

Management Type	Lake	Pctg. Similarity Index	Avg.
Raking	Clear	54%	56%
	Little Bald	68%	
	Lower Buckhorn	78%	
	White	25%	
Benthic mats/ sand	Lower Buckhorn	57%	38%
	Lovesick	30%	
	Pigeon	37%	
	Sturgeon	0%	
	White	27%	
Cutters	Lower Buckhorn	69%	71%
	Lower Buckhorn	54%	
	Sturgeon	90%	
	Sturgeon	72%	
Herbicide	Pigeon	6%	51%
	Sturgeon	95%	
Corn for Carp	Sturgeon	73%	58%
	Sturgeon	43%	
Mechanical Harvester	White	31%	31%

Algae

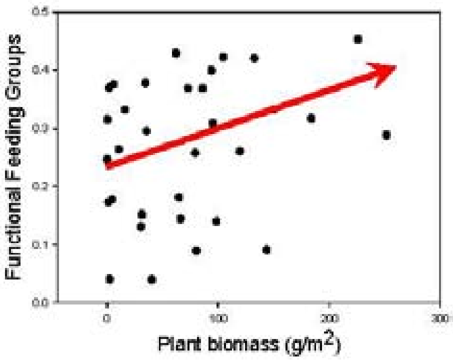
As troublesome as they may be, aquatic plants are preferable to large collections of filamentous algae in the water. Most lakes and study sites had some algae by late summer, either free-floating (phytoplankton), attached to plants (metaphyton), or growing on the sediment (epipelic).

Algae from a benthic mat site.

In order to determine if management techniques were increasing the amount of algae at a site, we compared reference and managed sites. If algae was present at a managed site, we looked to see if there was more or less algae than at the reference site. On White Lake, 22% of the plant biomass at the reference site was algae attached to the sediment. At the mechanical harvester site on that lake, these epipelic algae increased to 48%, and at the benthic mat site, they again increased to 92% of the biomass! Only the raked site on White Lake reduced the amount of algae, down to 8%. On Clear Lake, raking was also successful at decreasing the amount of epipelic algae, from 22% to 15%. Other sites did not have enough algae present in the reference communities to make a good comparison. From the sites where algae was present, it seems that methods that do not remove plants frequently, such as benthic mats and harvesters, can allow large quantities of epipelic algae to build up. Raking, which is done repeatedly, appears to decrease the amount of this algae.

Aquatic Macroinvertebrates

Big words for Larvae, Beetles, and Bugs



The distribution, abundance and productivity of benthic macroinvertebrates (snails, larvae, beetles, worms, etc. that live in the sediments and on the plants of our lakes) can tell us many interesting things about the nearshore environment of our lakes:

Habitat: certain species are only found in certain types of habitat, like soft mud, or rocks and gravel.

Disturbance: some species are intolerant of disturbance or alteration to their environment; if these species are present we know the area is healthy.

Food webs: invertebrates have many different ways of obtaining food, from parasitism (leeches feeding on blood) to scrapers (snails feeding on algae attached to plants); these are called functional feeding groups. More feeding groups mean many different food sources for invertebrates and more complex food webs. Complex food webs are a sign of a healthy lake.

The graph at the top of the page shows a potential impact from plant removal through plant management techniques. It shows the relationship between plant abundance as biomass (on the horizontal axis) and an index of the number of invertebrate feeding groups (on the vertical axis). Each dot represents the biomass and invertebrate feeding group index for one site in the study.

The red arrow shows the "best-fit" line; when all the dots are put together, this is the line that best represents the relationship between all the dots. The arrow points upwards to the right, which means that sites with more plants have more feeding groups and thus healthier environments.

If we look closely at some of the individual study sites in the table below we see that, irrespective of the type of management option that shoreline residents are using, there are negative impacts on the density of macroinvertebrates. This happens even in those situations where we didn't see large shifts in the plant community following treatment. For example, in the table on page 22, the Percentage Similarity Index for the herbicide treatment on Pigeon Lake was only 6%, while for the same treatment on Sturgeon Lake it was calculated to be 95%. The trends are not as consistent when we look at the number of different species that were found (species richness), but again there is a trend for loss of species following all treatments. We also saw new species appearing (especially snails), which were likely taking advantage of newly created habitat.

Lake	Treatment	Density (# individuals collected/100 seconds)	Species Richness
White	Harvester	444	9
	Reference	909	17
Pigeon	Herbicide	51	17
	Reference	2133	14
Sturgeon	Herbicide	760	16
	Reference	2496	23
Sturgeon	Cutter	991	19
	Reference	2496	23
Lovesick	Benthic	373	14
	Reference	1221	16
Little Bald	Raking	51	11
	Reference	917	21

What do we conclude?

Keep in mind that decreasing plant biomass means the method is effective, but changing the plant and invertebrate communities reflects changes to the localized aquatic habitat. This could have ramifications on other parts of the ecosystem such as fish, birds and mammals.

Raking/Dredging consistently reduces plant biomass, compared to reference sites. This may decrease the invertebrate feeding groups. On average, this method causes moderate changes to the plant community (average Percentage Similarity Index or PSI 56%) but in some cases can strongly change the community (only 25% PSI on White Lake). Raking helps to remove algae, when present.

Benthic mats (not allowed in the TSW) and sand (not allowed in Ontario) were both able to significantly reduce plant biomass, which may negatively impact the invertebrate feeding groups. They change plant communities very strongly (average PSI 38%), with mats causing more change than sand. When present, algae can build up on top of the mats and comprise a large proportion of the plant community.

Herbicide treatments varied in their results. One site had a slight reduction in plant biomass compared to the reference site and very little change to the plant community (Sturgeon Lake, PSI 95%), whereas the other treatment site had greater biomass than the reference site due to an abundance of *Chara*, a disturbance-tolerant species, and had a strongly altered community (Pigeon Lake, PSI 6%). Results appear very site specific: the former was along an exposed shoreline, and the latter within an enclosed bay. Impacts to invertebrates will depend on the plant abundance changes specific to the site.

Corn for carp reduced plant biomass to a greater extent in the early summer than in the later summer. Plant communities were moderately similar between treated and reference sites (average PSI 58%). The decrease in biomass, especially in early summer, may impact invertebrate feeding groups.

A **mechanical harvester** was used at only one site in this study, so results may not be representative. Here, plant biomass was much lower after the treatment and in late summer, perhaps impacting the invertebrate feeding groups. There was a strong change to the plant community following the treatment, PSI 31%, which was partly due to algae. Algae was present at this site prior to treatment, and its proportion in the community increased after treatment.

Cutters produced the least decrease in plant biomass, with managed sites often having only slightly lower biomass than reference sites. Cutters remove biomass from the upper portion of the water column, which allows for boating and swimming activities, but leaves plant communities intact near the lake bottom. Cutters caused the least change to the plant community, indicating that the natural community is being preserved. Invertebrates would probably be minimally impacted by this method.

The KLSA study did not directly measure the effects of any of these control methods on fish communities or Species at Risk (SAR). This is why the permitting process is so essential: Authorities take the whole habitat into account when issuing permits. It is best to err on the side of caution: consider other short-term measures in living with aquatic plants, such as building longer docks out into deeper water or using swim platforms, thus avoiding the plants.

For the longer term, to reduce nearshore aquatic plant growth, support policies to reduce excess phosphorus and nitrogen inputs to the lakes (good urban stormwater management, updated sewage treatment, responsible agricultural practices) and be a good shoreline steward by keeping your septic system well maintained, keeping lawn and garden fertilizers far away from the shore, and creating a natural buffer zone of native plants at the shore to help shade the water, stop erosion and lessen runoff. Also, educate yourself as to the type of habitat your shoreline contains as this will directly affect the amount of aquatic plants that will be present. For example, shorelines that have shallow slopes, lots of emergent vegetation, and a lake bottom that is fairly mucky are probably more wetland-like in their characteristics and thus you would expect to find submersed aquatic vegetation growing there.

Summary Table of Aquatic

Method	Size of area managed	Cost	Cost sharing? Cost frequency	Frequency
Raking or home -made dredge	Small – swimming or dock area	Rakes: $20 to $100. Dredges $0 to $100 + boat/gas	Yes – can be shared among neighbours. Buy once	Weekly or as needed
Benthic mat or sand on the lake bed	Small – swimming or dock area	Depends on size, $200 to $700	No – cannot be shared. Buy once	Once – mat removed in the fall
Cutters – mounted on a boat or thrown	Large – swimming, dock, boat channel	Up to about $2,200 to buy.	Yes – can be shared among neighbours. Buy once	Biweekly or as needed
Herbicide – Reward®	Medium – swimming and/or boat channel	$80 minimum if self-applied. Cost of commercial appli-cation is estimated on a case-by-case basis	Yes – can be shared among neighbours. Every year	Once
Corn to attract carp	Small – swimming or dock area	Minimal	No – cannot be shared. Every year	Weekly or as needed
Mechanical harvester	Large – swimming, dock, boat channel	Depends on the area, $650 - $1500	Yes – can be shared among neighbours. Every year	Once

Plant Management Methods

Timing	Reduces plants?	Change to plant community	Algae (if already present)	Permit requirements
July or later	Yes	Moderate	Removes algae	Dredges/drags are not recommended and are not allowed on the TSW; they may harm fish habitat; raking is OK in small areas
July or later	Yes	High	Increases algae	Not permitted in TSW. Elsewhere, consult local agencies. Sand below high water mark is not permitted in Ontario
July or later	Yes, but mainly near the surface	Low	Unknown	Consult local agencies for size restrictions on cut area; permit required on TSW
July 15 to 30	Depends on the site	Variable – both very high and very low	Unknown	Purchasing and ap-plying require permit; permit specifies timing
July or later	Yes, more so in early summer	Moderate	Unknown	No permit required
Usually July or early August	Yes	High	Increases algae	Consult local agencies for size restrictions on cut area; permit required on TSW

Identifying Aquatic Plants

Aquatic plants are often beautiful and interesting as well as useful. If we stop thinking of them as "weeds," we can enjoy noticing, examining and identifying them. This guide includes some of the common species of aquatic plants found in the Kawartha Lakes. Drawings are not to scale.

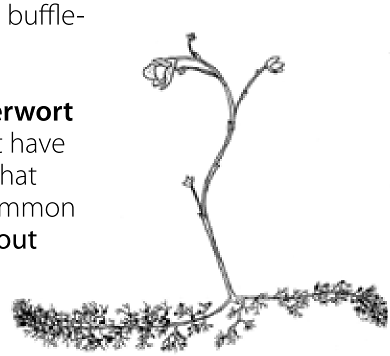
Floating Plants

Ceratophyllum demersum – Coontail

Coontail is a floating plant that has no roots. The leaves are 1-3 centimetres long and whorled on the stem with 5-12 leaves per whorl. The leaves of coontail separate into two thin segments at a time (never more than this). The edges of the leaves have tiny serrations that feel rough to the touch. Coontail can be found in waters of up to 7 metres deep in lakes, ponds, streams and slow moving rivers. Its leaves and seeds are enjoyed by waterfowl, fish and even muskrats throughout the year, and provide shelter for many aquatic invertebrates. Coontail does not respond well to raking, cutting or harvesting because the small fragments left behind can reproduce.

Lemna trisulca – Star Duckweed

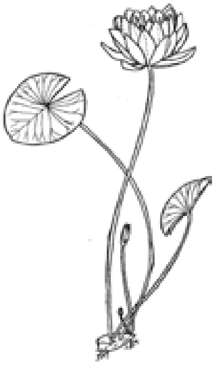
Star duckweed is a very common, small, free floating plant with no roots. It has small (2-5 mm), **completely flat, blade-like leaves** – often one larger blade with 2 small blades on either side forming a "star." These clusters join together with other clusters by thin stems to form **long interconnected chains**. The colour of star duckweed is usually **dark green**, which can almost seem translucent. Among the smallest plants in the world, duckweed, not surprisingly, is a favourite food of ducks such as mallards, buffle-heads and wood ducks.



Utricularia vulgaris – Common Bladderwort

Bladderworts are carnivorous plants that have bladders, or sacs, on the stem or leaves that they use to trap tiny aquatic animals. Common bladderwort is a free floating plant **without roots** which typically floats just below the water surface. Its leaves are **alter-nate** and are **finely divided** into leaflets. The leaves can be up to 5 cm in length and become dense towards the stem tips. Flowers are yellow, 2 cm wide, and are found on stalks above the water's surface. The bladders are scattered along the leaflets, are about 2-4 mm in diameter and are black when prey are inside.

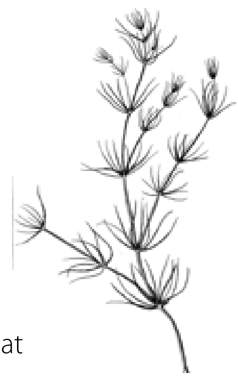
Floating-leaf Plants



***Nymphaea ordorata* – Fragrant Water Lily**
Fragrant water lily has **round leaves**, with a **V-shaped split,** and **pointed lobes**. The 7-30 cm long leaves have long, thin stems that attach them to the underground roots. This lily gets its name from its fragrant white flower, which is 7-20 cm wide. The flowers will float on the water surface and open only from mid-morning to early afternoon. The Ojibway ate the flower buds and used the rhizomes (roots) as medicine for several ailments. The shady environment created by this lily provides excellent habitat for largemouth bass and sunfish, and it is therefore best left alone.

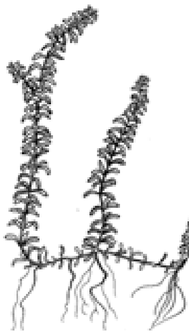
***Nuphar variegata* – Yellow Pond Lily**
Yellow pond lily is recognized by its **heart shaped leaves** with **rounded lobes**. Its stems are flat on one side and may be up to 2 metres in length. Accompanying the large 10-25 cm long leaf is a showy yellow flower which ranges from 4-6 cm wide. In mid- to late summer, yellow pond lily produces red berries. A favourite food of moose, this lily also provided food for native people. The seeds can be cooked as corn or popcorn, and the rhizomes (roots) as potatoes.

Submersed Plants



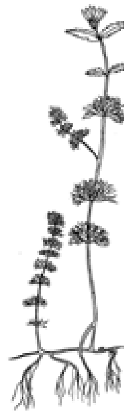
***Chara* – Muskgrass**
Muskgrass is actually a type of algae referred to as macroalgae. Macroalgae arrange their cells to look like a larger plant but are actually just a series of cells attached to one another. *Chara* is noted for its **musky smell**. Its "branches" are **whorled, rough and appear to be lined**, and grow up to 12 cm in length. The whorling along the stem is often evenly spaced and the stems tend to be brittle. These hardwater lake plants often have lime deposits on them. *Chara* and the tiny animals that live in it are a main food for ducks. Unlike most aquatic plants, *Chara* can grow at depths below 10 metres.

Elodea canadensis – Canadian Waterweed



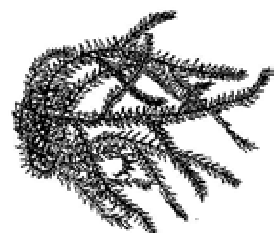
Elodea is a perennial herb, which has **leaves in whorls of three** all the way up the stem. The small leaves (1.2–4.5 cm) become crowded towards the tip. The leaves are small in comparison to the height (10-40 cm) of the plant. It is also very common for the stems to branch. This plant often forms thick mats on the bottom of the lake, which sometimes even fish cannot penetrate, with the occasional long stem extending up into the water column. With their **bright green colour** and stiff habit, these plants resemble artificial aquarium plants.

Megalodonta beckii – Water Marigold



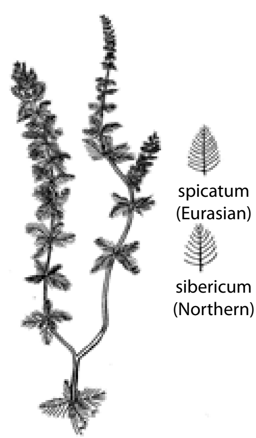
Water marigold appears to have whorled leaves (2-5 cm long) that dissect into **threadlike, feathery segments**. If you look closely at the point where the leaves join the stem, what you will see is that the **leaves are actually opposite**, but they start branching so quickly from the stem that the leaves seem to start from all around the stem. The leaves of Megalodonta **will not have any serrations** on the edges. The flowers, which attract insects, appear in late summer, are golden-yellow, and extend above the water's surface. The small, rounded, barbed fruits are attractive to shorebirds.

Moss



There are numerous aquatic mosses found in lakes; however, the most common one resembles mosses that you might find on land. It grows in clumps and can be loosely attached to rocks or underwater debris via root-like structures. The leaves are small and pointed, and they overlap along most or all of the stem. The stems branch repeatedly.

Myriophyllum – Milfoils



The milfoils can be identified from their 1-5 cm long leaves, which resemble feathers: they have many threadlike leaflets extending on either side of a central axis. How the leaves are arranged on the stem and the number of leaflets on each leaf will help you identify the different species. Flowers are on single spikes that extend above the water's surface.

***Myriophyllum heterophyllum* – Variable Water-Milfoil**
Variable water-milfoil has leaves that **resemble feathers and are whorled along the stem**. It can be distinguished from other milfoils by its **bushy, "fox tail" appearance.** Whorls of leaves are spaced very close together along the stem, leaving hardly any stem exposed. The number of leaflets is variable.

***Myriophyllum sibiricum* – Northern Water-Milfoil**
Northern water-milfoil has leaves that **resemble feathers and are whorled along the stem**. However, the leaf whorls are **spaced apart along the stem**, leaving much of the stem exposed. At the tip of a stem, the whorls of leaves become bunched and take on a "knob-like" shape. Northern water-milfoil leaves have **11 or fewer leaflets on each side of the leaf**. (See lower inset in drawing on page 32.) The stem and tip of the branches may show some red colour late in the summer. This plant harbours many invertebrates, and is an important food source for waterfowl and habitat for fish.

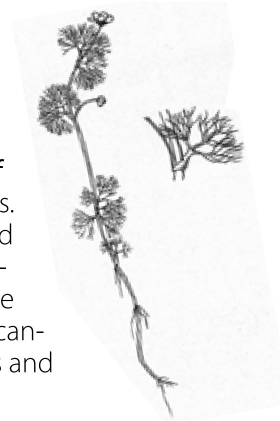
***Myriophyllum spicatum* – Eurasian Water-Milfoil**
The **invasive** Eurasian water-milfoil closely resembles northern water-milfoil: it also has **whorled leaves resembling feathers** that are **spaced apart along the stem**. Eurasian milfoil has **12-20 divided segments on each side of the leaf.** (See upper inset in drawing on page 32.) At the tips of the stem, the leaves and stem will have a **bright red colour**. Once this plant reaches the water's surface, it branches repeatedly, forming a canopy.

***Najas flexilis* – Water Nymph**

This slender, submersed plant has **glossy green leaves**, often bunched together along the stem, giving it a bushy appearance. Leaves are 0.2 to 0.6 mm wide and pair opposite to each other on the stem. The base of the two leaves joins together to form a **boat-shaped structure** around the stem. Other leaves fill in the "boat" with bunches of leaves. Water nymph leaves are wider at the base and tapered at the tip, and the edges are finely serrated. The leaves are often condensed near the end of the stem. The stem is slender, easily broken and may be up to 50 cm in length. Water nymph cannot tolerate water pollution, so its presence is a **sign of good water clarity**. It provides food for many types of waterfowl and food and protection for fish.

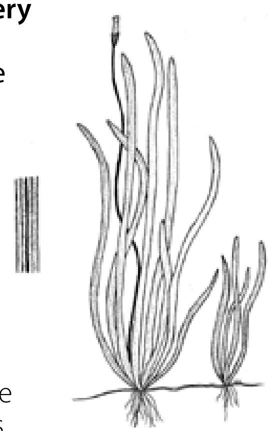
***Ranunculus longirostris* – Water Buttercup or Crowfoot**
There are two aquatic buttercups that are similar but can be distinguished by the small leaves (up to 2 cm long). Where the leaf joins the stem, there is a **sheath** that

wraps around the base of the leaf and the stem. On *R. longirostris*, the **leaf will branch into 3 leaflets directly above the sheath** – it may appear as though three leaves are coming out of the sheath because they branch so quickly. The other species, *R. trichophyllus*, will have a **single petiole that extends out of the sheath** before the leaf branches into three leaflets. On *R. longirostris*, flowers are small (1-1.5 cm wide) and white. All *Ranunculus* species contain poisonous, antibacterial substances. They were used by native people as an antiseptic, for rheumatism and even as an anti-cancer treatment. Small aquatic animals live in the leaves and are eaten by fish.



***Vallisneria americana* – Tape Grass or Water Celery**

Tape grass is common, native and abundant in the Kawartha Lakes. All of its **leaves originate from one point** on the lake bottom; however, they can grow very long (up to 1 m). The leaves are flat, 3-10 mm wide, ribbon-like, and vary in colour from light green to reddish. They are limp when removed from the water. The pattern on the leaves is very distinctive: veins are **darker/meatier in the centre of the leaf and almost translucent on the edges**. (See inset in drawing.) This plant spreads by underground roots and will usually be **connected to other plants**. All parts of the plant are eaten by waterfowl and muskrats, and diving ducks are especially fond of tape grass.



***Zosterella dubia* – Water Star-Grass or Mud Plantain**

This plant resembles the pondweeds because its leaves are **alternate and ribbon-like**. However, its leaves **lack a midvein** and instead show indistinct lines when held up to the light. Leaves are narrow (2-6 mm wide) and long (10-15 cm), and grass-like. The stem is slightly swollen where the leaves attach, and can grow up to 2 m in height. In the spring, this plant will regrow from the previous year's thin, black roots and may appear as small tufts of leaves along the root. In the summer, water star-grass sometimes produces yellow star-like flowers.

Pondweeds

Potamogeton **species or Pondweeds**

These are a diverse group that can be difficult to identify. However, all pondweeds have **alternate leaves with a visible mid-vein**: a plant must have both of these features to be a pondweed. Some species may have leaves so close together that they seem opposite, so check carefully. Potamogetons may have **2 kinds of leaves**: submersed leaves and leaves that float on the water's surface. They are a spring species, so you may notice them in your waterfront before other species. "Potamogeton" derives from the ancient Greek words for river ("potamos") and neighbour ("geiton").

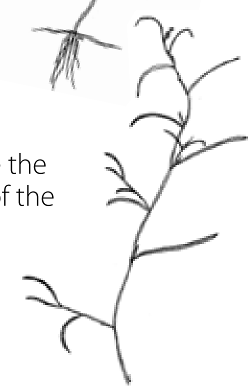
Potamogeton amplifolius **– Large-Leaved Pondweed or Bass Weed**

This pondweed has large (3-7cm wide, 8-20 cm long), **brown, wavy-edged, submersed leaves** with large parallel veins. The large leaves "amplify" in size along the stem towards the tip. **Floating leaves** are also present later in the season. These leaves are elliptic, leathery, and waxy on the upper surface. Identifying these plants by floating leaves alone is tricky, but the submersed leaves are unmistakable. The plant provides habitat for fish and aquatic insects, and food for waterfowl.

Potamogeton crispus **– Curly-Leaved Pondweed**

Curly-leaved pondweed is a **non-native species in the Kawartha Lakes**. Its leaves are submersed, about 4–7 cm long and 5-10 mm wide, with very wavy margins and conspicuously serrated edges. The plant has a ruffled look. This plant can also be found floating across the top of the water creating a mat on the surface.

Potamogeton pusillus **– Small-Leaved or Slender Pondweed**



Small-leaved pondweed can be identified by its **small (0.2 to 2.5 mm wide, 2.5 to 5 cm long), blunt tipped leaves**, which have tiny circular glands where the leaf meets the stem. It also has **sheaths** at the base of the leaf which are delicate and greenish-brown to white in colour. The stems are irregularly branched. This species has become common in the Kawartha Lakes recently and will form dense mats early in the summer, then die and sink to the bottom by late July.

Potamogeton richardsonii – Richardson's Pondweed

Richardson's pondweed has **leaves that clasp, or wrap around, the stem** at their base. The leaves are usually less than 10 cm long and 2 cm wide, and can appear opposite when they are closely spaced. The leaves can vary from circular to long and narrowing at the tip. They have wavy margins, and are well spaced along the stems. Where the leaves join the stem, there may be a bunch of white hairs which can be fairly coarse.

Potamogeton robbinsii – Robbin's Pondweed or Fern Pondweed

Robbin's pondweed often has a **very dark green leaf** and **resembles a fern**. The leaves of this pondweed are very conspicuous with their long length (3-10 cm long, 3-8 mm wide) in comparison to its stem. The leaves are stiff, not serrated, and come to a point at their tip. When viewed from above there are 2 bracts of leaves (only 2 rows of leaves can be seen). This pondweed can act as a fertilizer in wild rice beds. Although it is a poor food for waterfowl, moose enjoy it.

Potamogeton zosteriformis - Flat-Stemmed Pondweed

Flat-stemmed pondweed is easily identified by its **flat stem**: hold the stem between two fingers and try to roll it. You will be able to feel the flat stem and it will not roll at all. The leaves are alternate, flat and narrow (about 2-5 mm wide, 10-20 cm long) and often have a tiny leaf wrapped around the base of the main leaf. These plants can grow to 2 metres long. "Zosteriformis" means "ribbon-like."

Glossary

Alternate leaves – leaves that appear singly, first on one side of the stem and then on the other

Benthic – refers to the environment on the lake bottom

Biomass – the mass of living biological materials (i.e. aquatic plants or macroinvertebrates) for a given area at a given time

Chlorophyll *a* – a pigment produced by plants, which is used to obtain a relative measure of the amount of algae in the water

Emergent plants – plants with stems and leaves that stand erect above the water's surface

Epipelic – algae that grows on the lake sediment

Floating-leaf plants – plants whose leaves lie flat on top of the water; underwater structures are limited to stems or developing leaves that have not yet reached the surface

Floating plants – plants that are not anchored to the sediments, but are free-floating; they may or may not have roots; can float both on the water's surface and underwater

Food web – pathways by which nutrients are cycled through the different trophic levels (i.e. sediment, plants, insects, fish) of the lake

Invasive species – non-native species that are able to grow and spread rapidly in new environments

Littoral zone – the area from the water's edge to roughly where sunlight no longer penetrates to the lake bottom; also the region of a lake where aquatic vegetation grows

Macroinvertebrates – small aquatic animals visible to the naked eye, such as snails, worms, leeches, mayfly, damsel fly, and dragon fly larvae, and crayfish

Metaphyton – algae that aggregates among aquatic plants and debris in the littoral zone of lakes

Opposite leaves – leaves that occur in pairs, joining to the stem on opposite sides

Petiole – the stalk of a leaf that attaches the leaf blade to the stem

Percentage Similarity Index (PSI) – a statistical test used to assess how comparable two different sites are with respect to the number and types of plants that are present

Phytoplankton – microscopic organisms, including both algae and bacteria, that produce their own food

Photosynthesis – the chemical process by which plants and other food-producers use energy from the sun to transform water and carbon dioxide into sugars

Piscivorous fish – fish that eat other fish

Reference site – an area similar to the treatment site in terms of location, sediment quality, and water depth, but which is not undergoing any type of plant control method

Sediment – the collection of sand, rock, mud, clay, and organic matter that makes up the lake's bottom; organic matter is any material that was once living but is now dead and decaying on the lake bottom, such as leaves, wood or last year's aquatic plants

Species diversity – a measure of the number of species and their evenness, or relative proportion, in the community

Species richness – the total number of different species found in an area

Submersed plants – plants whose structures are completely underwater; some plants may grow up to the water's surface and form a canopy

Water column – a theoretical (conceptual) column of water that extends from the sediments to the surface of the lake

Whorled leaves – leaves that occur in sets of 3 or more and are joined around the stem in a circle

Zooplankton – small aquatic animals, the larger of which are visible to the eye

The Aquatic Plants Guide crew: Colleen Middleton, Kyle Borrowman, Dr. Eric Sager, Lynn Woodcroft, Andrea Hicks, Jessica Middleton.

Lakes and Rivers of the Trent-Severn Waterway

Trent River
Percy Reach
Crowe Bay
Seymour Lake
Rice Lake
Otonabee River, including Little Lake, excluding north of the Hunter Street Bridge north to the Nassau Bridge
Lake Katchewanooka
Clear Lake
Stoney Lake
Lovesick Lake
Deer Bay
Lower Buckhorn Lake
Upper Buckhorn Lake
Chemong Lake
Pigeon Lake
Little Bald Lake and Big Bald Lake
Big Bob and Little Bob Channels
Sturgeon Lake
Scugog Lake and the Scugog River
Cameron Lake
Rosedale River
Balsam Lake
Gull River south of Coboconk
Mitchell and Canal Lakes and the connecting canals
Talbot River between Canal Lake and Talbot Dam
Canal between Talbot Dam and Lake Simcoe
Canal between Lake Couchiching and the Severn River
Sparrow Lake
Severn River
Gloucester Pool

Thank you ...

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